MISCELLANEA ZOOLOGICA HUNGARICA
Tomus 7. 1992. p. 65–70

Hydrozoological characters of a reconstructed wetland

by
S. Andrikovics, A. Bankovics, T. Csörgő, G. Gere, M. Sass and J. Török

(Received May 28, 1992)

Abstract: On the western shore of Lake Balaton there was a large territory of wetland, inhabited by diverse aquatic life and many species of birds. During the last century this marshy habitat was dried up by draining and broken into smaller areas. As a consequence the self-purification of the Zala River flowing into Lake Balaton greatly decreased. This situation is linked with the increasing anthropogenic effects and has endangered the water quality of Lake Balaton. Recently, large reservoir systems nearly re-establishing the original conditions have been built. This system gives an opportunity for studying the recolonization and succession types of different living systems.
Key words: Kis-Balaton Landscape Protection Area, reservoir system, water insect, waterfrogs, avifauna.

Introduction

Kis-Balaton wetland area situated at the western end of Lake Balaton, was a huge marshy area the until middle of the last century. The great drainings during the last century caused the ancient swampy area to shrink to a small plot of land of 1.5 km. Although the reclaimed lands were suitable for cultivation only to a small degree, the harmful consequences of the different interferences became more and more evident. Of these we should like to discuss the following two.

The first is that the formerly very rich bird-fauna of this area (Keve 1976, 1977) became alarmingly endangered, in spite of declaring the nature protection area. The second is that we must be fully aware that this area is crossed by the Zala River which is the biggest inflow of Lake Balaton. Formerly, the water of this river crossed an extensive marshy area and became biologically purified.

As the result of draining this process of purification did not take place. The lack of purification caused the Zala River, which transports water from Western Hungary, to bring harmful subtances in great quantities and increasing anthropogene loads. This endangers the water quality of Lake Balaton (Joó & Lotz 1980).

After the conditions had been evaluated, large scale reconstruction works begun in the Kis-Balaton area. Under this program a water-reservoir was constructed by the middle of the last decade, and there is an another one under construction. The water of the Zala River flows through this reservoir system in a wave line for the sake of biological cleaning and depositing.

The changes taking place in this area make it possible for us to make clear in a theoretical sense whether any ecologically degraded complex of associations could really be reconstructed. In this case we talk about the reversion of succession in the sense that we want to change a strongly polluted swamp, a bog, a

field, or harvest area into open water, into the lower section of running water, or into the ecological environment of a littoral region. After we contemplated these facts, our research was focused on two main areas:

1. Studying the development of the fauna in and around the newly established reservoir and comparing it with the relatively undisturbed fauna of the protection area.

2. Studying the feeding of animals and evaluating the consequences of their metabolism on water quality.

In the present paper our investigations concerning point 1. will be presented, whereas the questions concerning point 2. only those will be discussed which deal with the feeding of frogs. All other questions concerning different aspects of our investigations will be discussed elsewhere.

Methods

Certain groups of animals characteristic of the given biotope were studied, in spite of the fact that in the traditional biological monitoring system these groups are rarely taken into consideration.

We investigated the mayflies (*Ephemeroptera*), the dragonflies (*Odonata*), and the caddisflies (*Trichoptera*) out of insects, and the amphibians and the birds out of the group of vertebrates.

Larvae and imagos of the water insects were sampled by the traditional water and aerial nets, but imagos were also collected with the help of light traps. Amphibian populations were studied by walking through the area as well as by trappings. The changes occurring in the bird populations were followed also by walking through the studied area.

In 1987 for differentiation of the species of the *Rana esculenta complex*, gelelectrophoretic investigations of blood serum proteins were carried out (Vogel & Chen 1976, 1977, Uzell 1978). Altogether 26 blood samples (*R. lessonae* 8, *R. esculenta* 5, *R. ridibunda* 13) were analyzed using lactate dehydrogenase (LDH) and albumin for separation of species (see for methods Lőw *et al.* 1989).

Results and conclusions

In our surveys carried out in 1984 in the territory of the natural protection area, we found insect species in the water in very great numbers (e.g. *Platycnemis pennipes, Agrion splendens, Gomphus vulgatissimus).* Having compared our results with those of former investigations (Újhelyi 1955a, b) there were no significant differences.

However, in 1988 the species mentioned above were pushed into the background whereas in the newly established reservoir common mayflies appeared (*Cloeon dipterum, Caenis horaria, C. robusta*). In contrast to these species, *Potamantus luteus*, which is characteristic of the lower part of rivers seems to be proceeding towards extinction. This species can not tolerate water pollution.

At the same time, dragonflies appeared (*Coenagrion puella, C. pulchellum, Ischnura elegans, Sympetrum vulgatum, Anasciaeschna isoceles*). The most characteristic rare dragonflies in the territory are (*Aeshna viridis, Brachytron pratense, Leucorrhinia caudalis, L. pectoralis*).

Trichoptera of the studied area represent about 25% of all the species known to live in Hungary. The caddisfly fauna is relatively poorer than the dragonfly fauna (representing 50% of the Hungarian species, and this fact seems to be correlated with the high degree of water pollution). It is worth mentioning that stoneflies were not found in the investigated area because these species inhabit only clean waters.

The nature reserve area as well as the reservoir are inhabited by an amphibian fauna which seems to consist of a great number of species and individuals. Out of 11 species found in the nature reserve area only 8 were found in the reservoir as well (Table 1). Fire salamander (*Salamandra salamandra*) also lives in the nature reserve area. Its occurrence is a surprise because this species inhabits mainly the banks of brooks of Hungarian mountains of medium height. Its presence in the studied area may be explained by the cooler micro-climate of the swamps.

Table 1. List of amphibian species collected on the territory of Kis-Balaton

Species	former Nature Reserve Area	Water-Reservoir
Salamandra salamandra	+	-
Triturus vulgaris	+	+
Triturus cristatus	+	-
Hyla arborea	+	-
Pelobates fuscus	+	+
Bombina bombina	+	+
Bufo bufo	-	+
Bufo viridis	+	+
Rana ridibunda	+	+
Rana lessonae	+	+
(*Rana esculenta*)	+	+
Rana arvalis	+	+
Rana dalmatina	+	-

(In our estimation not considered as a distinct species)

The amphibians' density seems to be very different in the nature reserve area and for the reservoir. In the nature reserve area the estimated number of frogs were found to be 3500 ind./ha, in the autumn, whereas only 1/10 of the value mentioned above was found in the water reservoir.

Just like in the other parts of Central Europe, in the Kis-Balaton area, we registrated the occurence of 3 closely related forms of the water-frogs: *Rana ridibunda, R. esculenta* and *R. lessonae.* Because it was impossible to determine morphologically the immature specimens, which constituted a significant part of the sampled water frogs, we applied gelelectrophoretic method and were able to identify 3 lactic-dehydrogenase isoenzymes, characteristic of *Rana ridibunda*, as well as 3 other isoenzyme variants characteristic of *R. lessonae* and 1 isoenzyme variant characteristic of *R. esculenta*. It could be determined that the territory of Kis-Balaton is inhabited mainly by two parental forms, *R. ridibunda* and *R. lessonae*, whereas their hybrid, *R. esculenta* – contrary to our expectations – proved to be very rare. According to our investigations, *Rana lessonae* carries a serum-albumine of greater molecular weight, whereas the one present in the serum of *Rana ridibunda* is of a smaller molecular weight. The albumines found in the sera of *Rana esculenta* seem to confirm the hybrid characters of these animals.

The food consumed by the two dominant frog species (*R. arvalis, R. esculenta*) constituted – nearly without exception – of terrestrial species. Asellids, amphipods and larvae of dytiscid beetle – as characteristic aquatic prey animals for frogs

– were found only rarely in their stomach. The major part of their food consists of different mosquitoes in the spring, and of aphids and bugs in the autumn. Most of their prey were not moving or only slowly moving. Out of the vertebrates they consumed only amphibians but even them in small number only.

Both *R. arvalis* and *R. esculenta* seem to be generalistic opportunistic predators. Their diet at the same time proved to be very similar (Table 2). The rich food supplies made this possible even in the season when the density of the frogs was the highest.

Table 2. Percents of dominant food groups of *Rana arvalis* and *R. esculenta* in both studied areas of Kis-Balaton

Date	1987 Oct.-Nov.		1988 Apr.-May.		1988 Oct.-Nov.	
Taxon	*R.esc.*	*R.arv.*	*R.esc.*	*R.arv.*	*R.esc.*	*R.arv.*
Gastropoda	0.57	1.48	0.99	1.14	0.00	3.60
Isopoda	0.23	1.59	0.66	1.63	0.34	3.60
Diplopoda	0.17	0.63	0.17	0.33	0.00	0.90
Chilopoda	0.17	0.42	0.00	0.16	0.00	0.30
Collembola	1.13	3.07	0.17	1.47	0.68	1.80
Odonata	0.11	0.11	0.66	0.33	0.00	0.00
Orthoptera	0.00	0.21	0.33	0.16	0.00	0.00
Physopoda	0.90	0.32	0.00	0.16	0.00	0.00
Heteroptera	1.24	0.85	0.33	0.98	32.99	18.62
Aphididae	43.19	35.62	0.50	0.65	18.00	10.31
other Homoptera	2.71	4.23	0.00	0.98	4.42	6.01
Coleoptera	5.28	8.56	3.47	11.07	6.80	14.11
Lepid. larvae	3.28	2.43	0.00	3.75	1.70	7.81
Nematocera	10.51	6.45	88.93	61.50	17.35	9.01
Brachicera	11.53	9.83	2.15	3.75	2.72	4.20
Hymenoptera	8.93	9.30	0.99	3.61	8.50	3.30
Araneidea	2.20	3.49	0.50	6.85	3.40	8.11
Acaridea	4.18	5.07	0.00	1.14	2.38	5.11
Vertebrata	0.28	0.00	0.00	0.00	0.00	0.00
other	2.83	6.34	0.17	0.33	0.68	3.30

The reservoir area has a very rich bird fauna, which has been studied since 1984 when the area became flooded in May. Between 1984 and 1988 there were breeding bird species in the area. Among them 56 species part of the former breeding avifauna that was breeding here in the remaining habitat fragments of the former marsland. There were 28 species which were new settlers of the area after it was flooded (Bankovics 1991).

The dynamism of the immigration of the Caspian Grebe (*Podiceps nigricollis*) seems to be very interesting. First this species appeared in very great numbers but later its population decreased gradually. In 1985 the number of breeding pairs was 100, in 1986 150, in 1987 85 and in 1988 only 50. In 1989 this species disappeared from the area. Its breeding was uncertain in the Kis-Balaton area in 1990.

The population of one of the other similarly immigrated species, the Whiskered Tern (*Chlidonias hybrida*), increased between 1985 and 1988, and now this bird is also characteristic of the studied area. The rapid increase of its population has

been promoted by the fact that the water of the basin is overgrown with *Polygonum amphibium*, and it provides excellent nesting possibilities for the Whiskered Tern. The two species mentioned above may be examples of the different types of dispersal and immigration strategies of birds.

Since 1988 there have been new changes in the avifauna. In 1990 Cormorants (*Phalacrocorax carbo*) established a new colony in the water-reservoir. On May 30, 1990, there were 43 nests in the new colony, although 504 birds occured in the whole area. Some of the cormorants living in their traditional colonies, located in the strictly protected area (the former Kis-Balaton Nature Reserve), came to feed here from a distance of 6 km. The developing of this colony is rather slow. There were only 48 nets in the following year, on June 6, 1991.

The Mute Swan (*Cygnus olor*) shows a very dynamic immigration strategy. There were already three succesful breeding pairs in 1991.

Pair of White-tailed Sea-Eagle (*Haliaetus albicilla*) settled in 1989. They built their nest in the canopy of an ash-tree, but they did not breed in 1989 and 1990.

The Red-crested Pochard (*Netta rufina*) has a small, stable population here. There were 3 successful breeding families in 1991, but beside the 3 adult females with ducklings there were 8 adults without youngs.

The very great water surface as well as the very rich food resources attract not just a mass of Cormorants but also different Herons, though till now they were only feeding here and were breeding in the neighbouring areas. Only two of them breed in the water-reservoir regularly, the Bittern (*Botaurus stellaris*), and the Little Bittern (*Ixobrychus minutus*), in very low numbers.

The new water-reservoir has become an excellent resting and feeding site for a mass of migrant birds in the spring and autumn migration period.

Summing up we can conclude that the fauna of the water basin is now in the state of rapid development and establishment although characteristic swampy vegetation has not been formed until now, therefore the polluting substances transported here by the water of the Zala River can be destroyed very slowly. Unfortunately the grasses bordering the original river-bed of the Zala are systematically removed and this decreases the ancient filtering effect of the swampy area.

References

Bankovics, A. (1991): Avifauna changes of the Kis-Balaton Reservoir area. – *Miscnea zool. hung.* **6**: 23-30.

Joó, O. & Lotz, Gy. (1980): A Zala folyó szerepe a Balaton eutrofizálódásában (The role of the Zala River in the eutrophication of Lake Balaton). – *Vízügyi Közlem.* **1980(2)**: 225-256.

Keve, A. (1976): Beiträge zur Vogelwelt der Kis-Balaton I. – *Aquila* **82**: 49-79.

Keve, A. (1977): Data to the bird-fauna of Kis-Balaton II. – *Aquila* **83**: 191-226.

Lőw, P., Sass, M. Csörgő, T. & Török, J. (1989): Biochemical investigation of the *Rana esculenta* complex in the Kis-Balaton nature reserve, Hungary. – *Acta Biol. Hung.* **40**: 137-144.

Vogel, P. & Chen, S. P. (1976): Genetic control of LDH isoenzymes in the *Rana esculenta* complex. – *Experientia* **32**: 304-307.

Vogel, P. & Chen, S. P. (1977): A further study of LDH isoenzymes in the *Rana esculenta* complex. – *Experientia* **33**: 1285-1287.

Újhelyi, S. (1955a): Faunistical data of Central-European collections sampled by Hungarian collectors and kept in the Natural History Museum Budapest. – *Folia ent. hung.* **8**: 17-44.

Újhelyi, S. (1955b): Angaben zur Kenntnis der Odonaten – Fauna Úngarns. – *Folia ent. hung.* **12**: 103-116.

Uzell, T. (1978): Immunological distances between the serum albumins of *Rana ridibunda* and *Rana lessonae*. – *Proc. Acad. Natl. Sci. Phil.* **130**: 1-10.

Authors' addresses: Dr. Sándor Andrikovics
Dr. Géza Gere
Dr. János Török
Zoosystematical and Ecological Department
Eötvös Loránd University
Puskin u. 3
H-1088 Budapest
Hungary

Dr. Miklós Sass
Dr. Tibor Csörgő
Comparative Zoology Department
Eötvös Loránd University
Puskin u. 3
H-1088 Budapest
Hungary

Dr. Attila Bankovics
Zoological Department
Hungarian Natural History Museum
Baross u. 13
H-1088 Budapest
Hungary